The first general meeting of the Institute of Chemistry of Great Britain and Ireland will be held at the rooms of the Chemical Society, Burlington House, Piccadilly, to-morrow, at 4 P.M., to receive the report of the Council. A balance-sheet will also be presented by the treasurer.

We have received one more evidence of the revival of activity in Italy, in the shape of the first number of a new weekly journal, *La Rassegna Settimanale di Politica, Scienze, Lettere ed Arte*, in which a fair amount of space is devoted to science. It is published at Florence.

The following is a simple method recommended by Dr. Günther of Berlin, of observing the reversal of the coloured lines of flame-spectra. A thin platinum wire about five ctm. long, is fixed with one end in a glass tube (as holder), and one or two ctm. from the glass it is bent round to a right angle, and inserted in the envelope of a Bunsen flame, so that the free end, held vertical, is heated to a white glow. Into the diametrically opposite part of the flame-sheath is brought a sodium salt. This colours the flame. You then look through a weakly-dispersing prism (the combinations used for direct vision spectroscopes serve best), and through the sodium flame, towards the glowing wire. Two things are observed, (1) the spectrum of the monochromatic sodium flame, which appears in the form of the flame; (2) the spectrum of the glowing wire, which appears as a coloured band, but is broken by the dark D-line. Other metallic spectra may also be shown in this way; only care must be taken that the coloration of the flame be very intense.

At Hanover the skeleton of a mammoth has just been found, through some excavations which are being made for waterworks near the Ricklinger Beeke. At present only the skull and a tusk have been brought to light, the latter having the circumference of a human leg. The fossils are lying at a depth of six metres.

The publishing firm of Edouard Rouveyre, in Paris, announces the publication of a voluminous catalogue containing the titles, &c., of all those works, books, pamphlets, &c., which, in the period from October 21, 1814, down to July 31, 1877, have been prosecuted, suppressed, or confiscated, in France. It will appear in five parts, at two francs each.

At the beginning of the year the new Royal Library of Stockholm, which has now been transferred to the new building at the Humlegaarden, was opened to the public. The new edifice was erected after the design of the architect, Herr G. Dahl, at a cost of 900,000 Swedish crowns. The library, which at the beginning of the present century only numbered 30,000 volumes, now contains 200,000.

A new monthly periodical, exclusively devoted to the art of photography and its various branches, is being published since January 1, by Messrs. Ad. Braun and Co., of Dornach. Each number contains an artistic photograph. The title of the new serial is *Die Lichtbildkunst*.

Unusually severe avalanches are reported this winter from Styria. In the neighbourhood of Hieflau one descended upon a railway train, crushing the carriages, and wounding a number, while at Neuberg another fell upon a châlet containing twelve persons, none of whom escaped.

In the closing session of the German Chemical Society for 1877, Prof. Kekulé, of Bonn, was elected president, Professors Hofmann and Liebermann of Berlin, Prof. Fehling of Stuttgart, and Prof. Erlenmeyer of Munich vice-presidents. The Society elected also as honorary members the two physicists, Prof. Buff of Giessen, and Prof. Kirchhoff of Berlin, and Dr. Stenhouse of London. At the end of its first decade the German Chemical Society looks back upon a period of rapid growth in numbers and efficiency certainly unparalleled in the history of any society devoted to a special science. These results are due to several marked causes, which could well be imitated by other associations possessing analogous aims, viz., ease of admission, absence of entrance fee and smallness of the annual subscription, simplicity of the statutes, and rapidity and frequency in the publication of the proceedings. The number of members at present is 1,827, showing an increase of 229 during the year. Of these 206 reside in Berlin and 542 outside of Germany and Austria. The membership compares favourably with that of the older sister societies in London (952), and Paris (371). Although the annual payment is so small (15 marks) the society possesses a capital at present of 22,700 marks. During the past ten years the *Berichte* of the society have contained 3,726 communications, covering nearly 14,000 pages. A very complete index to this enormous amount of material will appear during the course of the present year, the compiler of which was selected by competition from among the twenty-nine applicants attracted by the unusually liberal appropriation of 5,000 marks for the work. In addition to the extensive chemical correspondence from America, England, France, Italy, Russia, Sweden, Switzerland, &c., the value of the *Berichte* in the future is to be increased by a complete series of abstracts on all papers appearing in German chemical periodicals. In the last number we notice a very full and interesting sketch of the late Prof. Oppenheim from the pen of Prof. Hofmann, as well as a detailed account of the Chemical Section at the German Association meeting at Munich by Prof. Liebermann.

The French Academy of Sciences numbers at present 63, three places being vacant by the deaths of Regnault, Becquerel, and Leverrier, the members being divided into eleven sections of six each. There are in addition ten French free academicians and eight foreign associates. The corresponding members, of whom there can be 100, are divided according to their nationality as follows:—France, 32; Germany, 19; Great Britain, 16; Russia, 6; Italy, 2; Austria, 1; Denmark and Sweden, 4; Switzerland, 4; Belgium, 2; United States, 3; Brazil, 1; and there are 11 vacancies.

The additions to the Zoological Society's Gardens during the past week include a Common Fox (*Canis vulpes*), European, presented by Mr. George Fredericks; two Black Swans (*Cygnus atratus*) from Australia, presented by Capt. W. H. Eccles; a Wood Owl (*Syrnium aluco*), European, presented by Mr. J. E. Liardet; a Common Magpie (*Pica caudata*), a Jackdaw (*Corvus monedula*), European, presented by Mr. G. E. Ladbury; a Hoary Snake (*Coronella cana*) from South Africa, presented by the Rev. G. H. R. Fiske, C.M.Z.S; a Jackass Penguin (*Spheniscus magellanicus*), an Upland Goose (*Bernicla magellanica*) from Chili, two West Indian Rails (*Aramides cayennensis*) from South America, purchased; a Derbian Opossum (*Didelphys derbianus*) from South America, deposited; a Hog Deer (*Cervus porcinus*) born in the Gardens.

RAINFALL IN INDIA

We have received so many long letters from India on the various aspects of the rainfall question that we must either, from want of space, leave them unpublished, or briefly give the gist of them. We adopt the latter course.

Mr. Archibald sends us a long letter on the seasonal rainfalls of Northern India in connection with the sun-spot period, in which he communicates a few of the principal results obtained from a more detailed and extensive comparison, which the paucity of data at his command hitherto had rendered it impossible to undertake. In the present investigation the registers of eight stations, four in Bengal, and four in the N.W.P. have been employed, and the two seasonal falls of each year, compared (1) for each station separately, and (2) for groups of four and all together, with its position in the sun-spot cycle.

The stations and the periods over which their registers of summer and winter rainfall respectively extend are as follows :—

		Summer rainfall. Years.	Winter rainfall. Years.
Bengal	Calcutta	43	44
	Dacca	24	25
	Hazaribagh	15	15
	Patna	18	19
N.W.P. ...	Dehra Dun	16	18
	Roorkee	16	18
	Meerut	15	17
	Benares	15	17

"When the deviations from the local average seasonal falls in each year are calculated for each of the above stations separately, and the average taken for each year of the sun-spot cycle, it is found, notwithstanding individual irregularities which occur chiefly in the summer falls, (1) that the winter rainfalls uniformly exhibit a marked tendency to vary *inversely* with the sun-spots at all the stations, (2) that the summer rainfalls show a corresponding tendency to vary *directly* with the sun-spots, which, though strongly marked at the stations in the N.W.P., is scarcely perceptible at the Bengal stations. The result is best seen by combining several of the stations together, and since, owing to the large differences between the actual amount of rainfall at different stations, it is impossible to combine the deviations from the local averages, registered in inches, I have arranged the latter in the form of percentages of their respective averages, then multiplied each percentage deviation in each year of the sun-spot cycle by the number of years corresponding to it at each station, added the several products for the same year, and divided by the sum of the multipliers. By this means each station contributes to the final result in proportion to the extent of its register." Mr. Archibald then gives the tabulated results of combining according to this method (1) the four Bengal stations, (2) the four N.W.P. stations, and (3) all together.

From these tables it is seen that with very few exceptions the inverse relation between the two seasonal falls is strongly manifested throughout, the winter rainfall generally tending to rise above the average in proportion as the summer rainfall tends to fall below the same, and *vice versâ*. The winter rainfall moreover in every case tends to rise to a single maximum exactly coinciding with the period of minimum sun-spot, descending thence to a single minimum which occurs a year or two after the period of sun-spot maximum. The summer rainfall on the other hand exhibits two maxima and minima, and though varying more or less directly with the spots, this variation is principally confined to the N.W.P. stations.

The preceding peculiarities may be rendered still more apparent if we take as a new mean for each year of the cycle the mean of the mean percentage of the year itself together with half that of the preceding and succeeding years.

On the whole it is evident (1) that the winter rainfall throughout Northern India as well as at Calcutta is subject to a periodic variation amounting to nearly 50 per cent. of the average winter fall and corresponding approximately with the inverse phases of sun-spot frequency ; (2) that the variation in the summer rainfall, though relatively much smaller, is of an almost exactly opposite character, and that while well-marked in the N.W.P., it is scarcely appreciable in Bengal ; (3) that from the last table the cycle may be divided into two distinct portions, viz., the five years preceding, and the six years succeeding, the year of sun-spot maximum. In the former the winter rainfall is excessive and the summer rainfall defective, while in the latter the inverse relations hold, a fact somewhat analogous to the periodic change in the direction of the wind at Oxford and Prague as recently determined by Messrs. Main and Hornstein.

It is scarcely possible at present to indicate the practical deductions that may arise from a consideration of the preceding data. One inference, however, would appear to be immediately deducible, viz., that in any future comparison of the rainfalls of Northern India and other countries similarly subject to distinct seasonal rainfalls, due to distinct aërial currents—such as the monsoon and the anti-trade winds—with the sun-spot period, the summer and winter falls should be compared separately, otherwise it may be found that the combined effect of two opposite seasonal variations renders the resultant variation in the total annual fall very insignificant, or perhaps obliterates it altogether.

With reference to Mr. Hill's letter in NATURE, vol. xvi. p. 505, Mr. Blanford writes that he learns that Mr. Hill was not aware of the existence of his (Mr. Blanford's) paper in the forty-fifth volume of the *Journal* of the Asiatic Society of Bengal (1875), "hence, perhaps, what I cannot but regard as his under-estimate of the extent and validity of the evidence opposed to his view. He discusses the registers of three stations, one in the North-west Himalaya, and two on the dry plains of the Upper Gangetic Valley. My conclusions were based on the data of eleven stations altogether, viz., one in Roorkee, which is also selected by Mr. Hill, and one in Behar ; one on the Eastern Himalaya, one on the plateau of Western Bengal, one in Orissa, one in the Andaman Islands, and the remainder in Lower Bengal and Cachar. Moreover, I was careful to eliminate all errors arising from the use of different uncompared instruments ; and how necessary such a proceeding is, I illustrated by the remark that I have known sun-thermometers bearing the names of the best London makers differing 10° and 15° in their indications when exposed side by side under similar conditions to the sun. This precaution Mr. Hill has not taken, and I think his results are probably in a great measure due to that fact." Mr. Blanford thinks the sudden changes in the Roorkee register may be accounted for by the fact that the thermometer was twice changed, and the apparent increase in the wind's velocity by the shifting of the anemometers at Benares and Hazaribagh.

With respect to what Mr. Hill has said of the elements of error probably inherent to the method of discussion which Mr. Blanford adopted, while he admits the great difficulty there is in eliminating the effect of disturbing causes, he cannot admit that any *systematic* error was introduced, in the way suggested by Mr. Hill.

Mr. Blanford concludes :—"While on this subject I would direct attention to the importance of regular actinometric observations, of an absolute not merely relative character (such as are shown by the ordinary sun thermometers). The importance of making the solar changes a part of meteorological study is now fully recognised, and it is understood that a trained photographer is about to be sent to India to take photographs of the sun, but if this is so, regular actinometric observation should certainly form a part of the work. The best place perhaps would be Leh, where the atmosphere is remarkably free from haze and dust, which is not the case on the plains of Upper India ; nor indeed, in dry weather, on the north-west Himalaya. At Leh, 11,500 feet above the sea, the radiation is most intense. Regular observations with the actinometer carried on for a few years at this place should satisfactorily decide the question of the variation of the sun's heat."

Mr. Blanford also sends a reply to the letter of "Old Madrassee" in NATURE, vol. xvi. p. 519. Mr. Blanford believes that to anyone who has seen or can readily refer to the report on the question of the periodical variation of the rainfall of Madras, it will be abundantly obvious either that "Old Madrassee" can never have seen that report or that he must have misinterpreted its whole purport and argument, and in his references to it, must have trusted to a somewhat unusually treacherous memory.

On the subject of solar radiation and sun-spots Mr. Hill writes that since his article (vol. xvi. p. 505) was written he has gone over the registers of four other stations at which solar thermometers have been in use for five or six years. The former method of treatment is not applicable to these on account of breaks in the registers and changes in the instruments ; but adopting suitable methods to compensate for this, the results are as given in the following table, which shows the variation of each year from the preceding one :—

Stations.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
	°	°		°	°	°	°	°
Benares . .	—	− 1·0	—	+ 0·4	+ 1·9	− 5·8	+ 3·3	+ 2·0
Gorakhpur.	− 0·6	—	—	+ 1·0	+ 0·9	− 0·4	− 2·7	− 1·5
Ranikhet .	—	—	—	+ 0·4	− 3·2	− 6·1	− 3·3	+ 2·9
Ajmere . .	—	− 2·0	+ 2·9	+ 1·7	+ 12·1	+ 3·2	− 4·7	− 0·3
Mean . .	− 0·6	− 1·5	+ 2·9	+ 0·9	+ 2·9	− 2·3	− 1·8	+ 0·8

Owing to inequalities in the number of months combining to give the averages in the table, and to variations in the number of clear days in each month, the changes from year to year are very irregular, but on the whole there is a decided increase from 1870 to 1876. The sudden fall from 1873 to 1874 must be attributed, Mr. Hill thinks, to the greater diathermancy of the clear air at three of the stations in the former than in the latter year. It is worthy of note that 1873 was a very dry year at all the stations, but that 1874 was much wetter than usual except at Ajmere, where it was drier than 1873. At this station the solar radiation temperature shows a rise instead of a fall between 1873 and 1874.

With regard to the change of anemometer referred to by Mr. Blanford, Mr. Hill says that fortunately, in the present case, any other pair of stations, such as Madras and Vizagapatam, will do as well. With reference to the possible variation of the winter rain of Europe according to the supposed variation in the force of the anti-trade, Mr. Hill notices that the rainfall of London shows such a variation, though not very clearly. He adduces some figures in support of this.

In Mr. Hill's paper, vol. xvi., the word *minimum*, p. 505, second column, eighteenth line from bottom, *exact*, same column, third line from bottom, and *commutative*, p. 506, first column, fourth line from bottom, should be *maximum*, *excess*, and *cumulative* respectively.

Mr. Hill also writes that the large double oscillation in the decennial period of rainfall in Southern India, pointed out by Mr. J. A. Broun, in NATURE, vol. xvi. p. 333, will probably be found to exist in other parts of the country, including the north. One of the longest continuous registers of rainfall in existence for any station in Upper India is that kept by the G.T. Survey Office at Mussoorie, in the Himalayas, lat. N. 30° 28′, long. E. 78° 7′, altitude 6,500 feet. The rain has been recorded since 1854, but only during the rainy season, May to October, inclusive; and the register down to 1873 has been already published by Mr. J. B. N. Hennessey, in the *Proc. R.S.*, vol. xxii. No. 152. Mr. Hennessey's table, extended down to the present year by means of a register kept by the Civil Surgeon, gives a general mean for the twenty-four years of 83·2 inches, and an absolute range of no less than 104 inches.

When the yearly rainfalls are arranged in series of two, three, &c., up to twelve years each, beyond which number it is impossible to extend the series without taking as representative the uncorrected falls of single years, it becomes evident that the great periodic oscillation that underlies the irregular variations must complete its cycle in from nine to twelve years, for the 9-, 10-, 11-, and 12-year series, all show a large amplitude of oscillation, and in the 11-year series the maximum and minimum occur at nearly opposite phases of the cycle. It is also evident that in the 6-year series the conditions are the same, the only difference being that the amplitude does not appear quite so great.

Calculating the coefficients of the equation of sines for the ten-and-a-half-year period, as Mr. Broun has done, we get for the variable part of the Mussoorie rainfall—

$$y = 11{\cdot}4 \sin \theta + 14{\cdot}0 \sin (2\theta + 337^\circ).$$

This may be compared with the equations given in Mr. Broun's article for Madras and Trevandrum,[1] for in all these equations $\theta = 0$ for the years 1838·5, 1849, 1859·5, 1870, &c. The difference of the two angles, 259° and 337°, causes a difference of more than a year in the epochs of the maxima and minima of the secondary oscillations, otherwise there is a wonderful similarity between the formulæ for two such widely-separated stations as Mussoorie and Trevandrum.[2]

Mr. Hill thinks it most likely that the oscillation of the five-yearly period is either purely accidental or the effect of some cause not yet understood.

Mr. Archibald, writing on the subject of Cyclone Generation, directs attention to an exceedingly interesting article in the *Pioneer* of October 30, entitled "A Cyclone Study," in which the author brings forward some very strong additional proof in confirmation of the "condensation theory" held by Messrs. Eliot and Blanford as opposed to the "parallel wind theory" advocated by Drs. Hann and Thau, and Messrs. Meldrum and Willson. After giving a clear account of the main points of difference between the above theories, the writer then proceeds to trace the history of the last cyclone in the Bay of Bengal, the Madras cyclone of May last, from its origin to its final disappearance, pointing out certain circumstances as giving strong support in favour of the condensation theory, and as completely disposing of the parallel wind theory—at all events as far as regards this particular cyclone.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The Mathematical Tripos' list this year contains ninety-four names. There are thirty-one classed as Wranglers, thirty as Senior Optimes, twenty-nine as Junior Optimes, and four Ægrotant. The Senior Wrangler is Mr. Ernest William Hobson, Scholar of Christ's College, eldest son of Mr. W. Hobson, proprietor and editor of the *Derbyshire Advertiser*. He was educated at Derby School, and in 1874 obtained an open scholarship at Christ's College. During his undergraduate career he obtained the first place among the students in the college examinations in mathematics. His college tutor was Mr. Peile, and his private tutor Mr. E. J. Routh, of St. Peter's College. Next to him are Mr. John Edward Aloysius Steggall, scholar of Trinity College, and Mr. Christopher Graham, scholar of Caius.

During the present term three courses of lectures on chemistry will be delivered. A general course by Mr. Main at St. John's College; a course by Mr. Lewis at Downing College; and a course on the non-metallic elements by Mr. Pattison Muir at Caius College.

MUNICH.—The university is becoming in point of numbers one of the foremost in Germany. The calendar for the present year shows an attendance of 1,360, of whom 1,014 are from Bavaria and 346 from other countries. In the theological faculty there are 82, in the legal 387, in the medical 341, in the philosophical (history, philology, &c.) 246, (science) 151, together with 136 pharmaceutical chemists, and 17 in forestry and agriculture. The corps of instructors numbers 114. The university, although but fifty-two years old, has been well supported by the State, and possesses a large variety of laboratories, cabinets, &c., and a library of 20,000 volumes.

SOCIETIES AND ACADEMIES

LONDON

Royal Astronomical Society, January 11.—Dr. Huggins, F.R.S., in the chair.—A paper by Mr. W. F. Denning on suspected repetitions or second outbursts from radiant points, and on the long duration of meteor showers, was read, showing that a radiant in some cases continues active during three or four months, and sometimes a second outburst occurs after an interval of six months, so that meteors may be seen coming from the same radiant at opposite sides of the earth's orbit. Capt. Tupman commented on this paper at some length, and pointed out some of the difficulties these conclusions presented.—Dr. Wentworth Erck read a paper on a combined position and setting circle, rendering the declination circle unnecessary on large Newtonian equatorials. He also showed a small and singularly portable equatorial mounting, and read a note on a spectroscope made by Mr. Grubb for Prof. Young, showing certain improvements. Mr. John Browning admired the ingenuity of these, and explained which of them were new and which were not.—Mr. A. A. Common read a note on the satellites of Mars and Saturn.—A note was read describing the failure of the Melbourne telescope to deal with the satellites of Mars.—Mr. S. Waters read a paper on the distribution of the fixed stars in space.—Mr. Christie read a paper on specular reflection from Venus, the purport of which was that his recent observations of the planet with the polarising eye-piece emphatically corroborated those made in 1876. By means of this eye-piece the light of the disc is gradually reduced; and he found in every examination that the last part of the disc to disappear was situated at a point which was found by calculation to coincide with the point indicated by the theory of specular reflection, thus confirming Mr. Brett's original description of the phenomenon. Mr. Christie had the assistance of Capt. Tupman in his recent observations. Mr. Neison suggested certain other explanations of the appearances described, and after further discussion the meeting adjourned.

Zoological Society, January 15.—R. Hudson, F.R.S., vice-president, in the chair.—A communication was read from Mr.

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[1] Viz.: $y = 5{\cdot}4 \sin (\theta + 50^\circ) + 4{\cdot}6 \sin (2\theta + 252^\circ)$,
and $y = 5{\cdot}6 \sin (\theta - 17^\circ) + 8{\cdot}4 \sin (2\theta + 259^\circ)$.

[2] The above equation for Mussoorie gives the maxima in 1860·3, 1870·8, &c., and the minima in 1857·2, 1867·7, &c. The first term alone would give the maxima in 1869·1, 1870·6, &c., and the minima in 1855·9, 1866·4, 1876·9, &c.